# THE COMPUTER COMMUTER: NEIGHBORHOOD TRANSIT FOR THE 21ST CENTURY

**ANTON C. NELESSEN**

Associate Professor of Urban Planning and Policy Development
Rutgers University
New Brunswick, New Jersey 08901-1190

Founding Partner
A. Nelessen Associates, Inc (ANA)
Visioning & Town Planning
Princeton, New Jersey 08542


**Note: This is not the actual presentation given at the Urban Design, Telecommunication and Travel Forecasting Conference October 27 - 30, 1996, in Williamsburg, VA, but is a paper Anton Nelessen wrote and supplied on the same topic.**

This conference is focused on the potential impact of telecommunications on the future. Today we have heard a great deal about the potential relationship between land use and communications. I want to present a concept I have been researching for the past four years. I am currently completing a feasibility study to apply this concept in Bergen County, New Jersey. It combines the electronics of communication with small vehicles thereby allowing people to move easy and efficiently in the current sprawled urban pattern. It also provides an ideal transit mode to enhance the emerging neo-traditional urban form, and is an ideal retrofit for small communities and rural areas that can't afford any type of transit. It is only possible today because of the current evolution of computer, communications and satellite technology.

The suburban dispersed, low density pattern presents a challenge to transit operators. A flexible new approach to transit based on neighborhood needs can change long-held commuting habits. Most people know what's wrong with suburban transit. Simply stated, it does not go where people need to go when they need to go. In our (staff at ANA) informal observations around the country, the average number of people seen riding publicly subsidized 54-passenger vehicles at all hours of observations is five. Most school buses for upper grades operate at an estimated 15% efficiency rate, a tremendous waster of energy and resources.

There are five reasons that account for the failure of suburban transit: sprawled low density land uses, pricing, insufficient route and schedule information, Americas' dependence on the automobile and the negative images associated with transit.

**Sprawl**

Traditional fixed-route/fixed schedule transit was designed to serve the hub and spoke urban forms that characterized the 19th-century metropolitan development. Since World War II, however, development has shifted population out from the cities to the suburbs in dramatic numbers, and, as a result, automobile ownership has increased steadily while the VMT of vehicle miles traveled per person has increased even more dramatically, particularly in the past few years. Most suburban households have two cars, make ten or more trips per day and have an average commute of 27 minutes and pay approximately $5,900 per year to own and operate a two-year-old car according the American Automobile Association.

It is not difficult to understand the "affair" with the car in human terms, when the most popular new vehicle sold in American is a small plastic car/walker, typically given to two year old children by grandparents. Combine this with transit deprogramming of early teenagers at fourteen, when the ubiquitous yellow school bus becomes the "loser cruiser." This programming indicates how serious an image problem transit currently has for potential future customers. This image must be overcome by presenting a more positive image of transit. Our focus groups have indicated that we must and can improve both the functional and operational characteristics of transit, thereby attracting more customers.

Thus, there is now general agreement that, except for older urban centers and neighborhoods, most metropolitan areas are characterized by distances that are too long, origins and destinations that are too dispersed, population densities that are too low, stops that are too far away to walk to, and land uses that are too separated to enable fixed-route transit to compete for transportation trips. In fact, transit currently accounts for only two percent of all trips and most of that is commuting to work.

Attempts to respond to this dilemma—park and ride lots, HOV (high occupancy vehicle) lanes, carpools, van pools and feeder shuttles generally have not succeeded in motivating commuters to leave their cars behind. The only way many analysts now see an improvement in transit status is by radically changing travel behavior, life style, energy costs, and land use development policy to end sprawl thereby making transit work again.

The impetus to avoid the sprawl pattern that characterizes post-World War II America has received a great deal of attention in the press over the past few years and reflects many of the ideas of a growing group of planners, architects, developers, and traffic engineers, all called "New Urbanists."

This group has identified techniques like TOD or (transit oriented development) and have adopted successes like the LUTRAQ project in Oregon. Under LUTRAQ, 33% of work trips generated by TOD's would be by transit, or by foot or bicycle because new walkable mixed use neighborhoods will be connected together with light rail and bus. New urbanists also focus on reviving modified grid street patterns and building more compact, walkable communities with a mix of housing and jobs, retail, civic uses and parks in which car use is made less necessary.

One vision shared by the New Urbanists calls for walkable communities served by light rail which links other compact, mixed-use communities. However, TOD is not simply aimed at increasing transit patronage; rather, its proponents assume a significant interaction between well-designed pedestrian communities in which it is possible to walk to schools, parks, recreation, jobs, and transit stops, helping to shift attention away from land use density as the only factor affecting transit. The problem is that light rail is extremely expensive. The stops must be designed for an optimum walking distance similar to that supporting bus service, and requires high densities.

In fact, land use changes alone cannot solve the current suburban transportation dilemma. Not only does that approach make untenable assumptions that customers should adapt their lives to the needs of transit rather than vice versa. It also fails to account for the existing low density development pattern across America. What is needed, instead, is a fundamental redesign of the metropolitan transportation model that would eliminate transit's linearity and dependence on land use densities for service efficiency. A transit system that could begin to nurture the sense of neighborhood in typical sprawled housing developments and even could adapt to changes in climate.

**Pricing**

Economists typically argue that commuters choose the car over transit because the automobile seems to cost less. This perception derives from the notion that public policy has subsidized drivers with tax revenues collected from non drivers, leaving the real costs of automobile usage unaccounted for. A recent Planners Advisory Service report by Terry Moore and Paul Thorsnes, however, maintains that drivers do in fact pay—either directly (out of pocket) or indirectly (through taxation)—for nearly 90 percent of the cost of the nation's automobile- dominated transportation system. Indeed, in suburban areas, the taxpayer and the commuter are the same person. Moore and Thorsnes calculated that when the direct costs, taxes, and externalities (air pollution, accidents, and public safety) associated with owning and operating a car are combined, drivers pay $7,000 of the $8,000 that an automobile based transportation system costs per vehicle per year. Given that slightly more than half of all households now own two or more vehicles, many Americans pay in the range of $14,000 per year for automobile based transportation. It is difficult to believe that Americans do not realize how much they spend on automobile commuting or that they consider an expense of this magnitude negligible.

That Americans choose to pay more for driving versus transit likely points to the range of benefits not currently provided by transit. Thus, trying to encourage a shift to transit by focusing on the pricing of automobile commuting may not yield the desired result.

**Information Gap**

Another reason for poor transit patronage in the suburbs is the lack of information about routes and schedules, and if there is a schedule it is often not accurate. As an example in the past year, due to my recent move to a town, I take transit to the university some ten miles away. After nine months of bus commuting, the bus back from the university has been running an average of 14 minutes off

schedule, ranging from one minute to 35 minutes late, leaving the most avid rider frustrated. Maps and schedules can be confusing to read and are often in short supply. Transit stops are often poorly located or identified and perceived as negative in most Visual Preference Surveys™ I have conducted across North America. (1) Furthermore connections, fares and transfers between different forms of transit—such as bus to train—and even between different lines on the same system—such as one bus route to another—are often poorly coordinated. Routes are often circuitous and time-consuming: travel time for the commuter to work by automobile has remained fairly constant at 25 minutes for a 10-mile ride while it takes an average of 50 minutes for a 12-mile ride by bus transit. Finally there is the problem not often discussed in public that bus drivers may simply abandon whole portions of their routes so that the bus never arrives at particular stops. Reliance on transit in the suburbs, no matter how low the fare, often seems like a high risk proposition.

*(1) The Visual Preference Survey is registered trademarked of A. Nelessen Associates of Princeton New Jersey. An estimated 450,000 people have participated in a VPS. Participants are asked to rate images from +10 to a -10 based on whether they feel the image is appropriate for the location.*

**Americans and Their Cars**

For many Americans the automobile represents independence, freedom and the lure of the open road. Ironically suburban development patterns have reduced choice by making automobile ownership and driving a necessity and even a source of stress. According to one of the Barbara Walters specials, people are now being treated for "road rage" a form of stress that is generated by drivers competing for space in traffic congestion. Traffic congestion and the need for wider roads continues to strain local and national resources, decrease air quality with some cities having very serious air quality problems and produce visual chaos. Again based on Visual Preference Surveys™, the typical American arterial has an average value of -5 and below.

Recent research into suburban transit suggests that suburbanites may be ready for change, especially if that change offers options that meet or exceed the automobile's benefits in terms of immediacy, convenience and comfort, access, reduced traffic-related stress, improved livability of communities, and substantial cost savings.

**The Computer Commuter: Neighborhood Transit**

Neighborhood Transit is an alternative transportation concept that would put service within walking distance of 100 percent of all origins and destinations, regardless of density, thereby capturing a greater percentage of local trips than conventional transit. It is a flexibly routed/flexibly scheduled, point-to-point, on-demand system that offers suburban commuters something they have never before enjoyed: choice. It does not seek to eliminate automobile commuting but rather works with suburban pattern and preferences, not against them.

Neighborhood Transit (NT) is immediately distinguishable from urban transit in its most obvious

manifestation: its vehicles. NT's small buses are a cross between a limousine and a van and replace large buses, which are too massive and unwieldy to negotiate residential suburban streets and operate inefficiently when only partially full. By contrast, NT's low-floor vehicles provide accessibility while reducing passenger boarding time and thus dwell time at transit stops. Propane gas or electric buses, which are both quiet and nonpolluting, are especially appropriate for Neighborhood Transit. NT buses can be ergonomically designed with large windows, a ventilation system, personal lighting, and sound system.

The NT bus would be demand-responsive or available "on demand." What does "on demand" mean? The system as envisioned would work as follows: you dial 1-800-NDA-RIDE. The computer then asks, "What pedestrian precinct are you in?" and you punch it in. The computer next asks, "To which pedestrian precinct(s) would you like to go?" You then punch in your response. The computer answers, "six minutes, happy to serve you." In six minutes, a small bus arrives at your Neighborhood Transit Stop. All you need is a map, which numbers the various pedestrian precincts your and a telephone. This is all accomplished using GIS, GPS, Digital packet data, and new on-demand response computer programming. Many Americans today use small buses at airports to reach their rental cars. Notice that all these buses are now equipped with computers and are linked to several service terminals. At Hertz you can now rent a car with a GPS and computer mapping/directional finder in your car. Digital telephone in cars have been standard now for years. The neighborhood transit simply applies this to small buses and cars which travel between point and point on demand.

Your privately operated neighborhood transit company provides the map, which is subdivided into a series of small, numbered circles or pedestrian precincts. Each circle circumscribes a five-minute walk to a center or bus stop. When the bus arrives, you pass your credit or bank card through the reader located inside the door of the bus. You are billed monthly. If you are a first time user the driver will give you information to enroll in the system and register your personal PIN number, further simplifying the access calling and billing of your account.

The information and communication technology required to operate and manage such a neighborhood transit system calls for a wide range of capabilities—from monitoring vehicle locations to informing potential riders of the arrival time of the next bus to dispatching appropriate vehicles in response to demand to tracking reservations for regular users to accommodating a wide range of fare payment methods (including credit cards and bank cards). Dramatic improvements in the power, memory, and processing capabilities of computers, coupled with the development of increasingly sophisticated yet user-friendly geographic information systems, scheduling programs, and communications technologies, mean that the capabilities of handling the complexity of NT now exist.

Reliance on state-of-the-art information and locating technologies alone will not make the system succeed, however. Neighborhood Transit is also changing the way routes and stops are laid out. A key underpinning of the system is public involvement in locating stops and drawing pedestrian precinct boundaries to increase community satisfaction with the responsiveness of the system and to tie transit stops to community planning goals. Stops are simple and flexible. The most common stop is little more than a flag with a number and several paving blocks. Since there is little if any waiting time, no

elaborate shelters are required. A further advantage is that the stops can change location depending on weather. For instance in cold winters and the hot humid summers, the location of the stop can be closer that the typical five minutes apart. It is a simple matter to change the location of the stops on the computer and moving the flag.

**Service Areas**

A service area is defined as the area within 25 minutes of where patrons live and where most, if not all, local trip destinations are located. This service area should be laid out to capture a significant number of all local trips with view toward meeting rider needs and expectations rather than only meeting cost-effectiveness criteria. Traditional vehicle-based concepts of headways (time between vehicles), corridor density, direction of service, and average speed have little meaning compared to such passenger-based performance measures as waiting time, ride time, ride quality, and repeat customers. There are no hard rules regarding minimum population, densities, mix of uses, or geographic characteristics for determining pedestrian precincts or service boundaries. In addition, service areas can cross jurisdictional boundaries, just as travelers do.

Two basic concepts govern the design of a service area. The first is time, which is more important than distance and, for many people, more important than cost: a service area is laid out so that the regional median trip time does not exceed about 20 minutes. The time required to traverse a service area should average no more than about 30 minutes. The temptation to increase service area size to make more cost-effective use of vehicles or to capture more potential riders should be stubbornly resisted. Multiple, even overlapping, service areas with a central dispatch center are preferable to enlarged service areas.

The second concept is diversity rather than density. Each service area should account for a mix of all important local destinations, including schools, shopping districts, recreation areas, religious institutions, employment centers, and local stops connecting to other transit routes. Surveys and focus groups of community residents, major employers, and shoppers should be conducted to determine origins and destinations.

**The Pedestrian Precinct**

The basic service unit in Neighborhood Transit is the pedestrian precinct, which falls into one of three size categories. The primary and most often used precinct type is a circle that encompasses 162 acres, which has a radius of 1,500 feet and equates with a five to six-minute walk. A second type encompasses 230 acres elongated around a mixed-use core of about two blocks or 1,000 feet. Because such a core includes interesting diversions, people typically walk the extra distance, as they do in a shopping mall. A third precinct could he 500 acres with a dimension of one-half mile (a 10-minute wake). Walking distance can lengthen to 10 minutes when the destination is a school, work site, or commuter stop on fixed-route transit as long as the pedestrian experience is comfortable and safe. Once walking distances exceed 10 minutes, the temptation to get into a car and drive generally wins out. In addition to the above, special stops, typically at or near the front door, are located to accommodate

buildings with over 50 employees. When locating the pedestrian precincts on the GIS, places of employment which include retail, offices, industrial, service and institutional uses are plotted first.

After locating the major employers, the three basic sizes of pedestrian precincts are overlaid everywhere on a map of the service area. The interconnection of the center points of the precincts then forms the basic Neighborhood Transit network. Located at the center of each precinct is a Neighborhood Transit stop center, which local users select. The primary design criterion requires that no residence, business, recreation, or activity center be more than 1,500 feet (a five-minute walk) from a transit stop. Stop centers may take the form of traditional bus or rail stops, main streets, town greens/ playgrounds, corner stores, strip malls, libraries, parks, or any of a number of local landmarks.

The transit stop centers must be attractively designed and identifiable through information-rich architecture that reflects neighborhood needs and preferences. They can range from the simple (merely a flag/sign) to the complex (with benches, shelters, bicycle racks) as long as they are sufficiently recognizable to encourage use. Stops should always be placed within an activity center—for example, near the front door of a busy office building or near retail shops—not at the curb of the arterial street or at the edge of a vast expanse of parking lot.

Research and experience have demonstrated that the decision to walk—and hence to use transit—is influenced by the walking experience. Thus, the character of the walking routes to and from stops is just as important as the character of the stops themselves: pedestrian-friendly routes, connections, and enhancements are a necessity. Good sidewalks make good transit.

The pedestrian precinct is also an important tool to define a neighborhood. Many of the existing subdivisions are not neighborhoods. They have no center, focus or defined boundary. The overlaying of the pedestrian precinct with the NT stop may begin to define the center and therefore has the potential to help define neighborhood, over time creating a better sense of community.

**Cost Factors**

Neighborhood Transit competes for so-called choice riders in the marketplace. Its target audiences distinguish NT from typical public transportation systems, which provide subsidized service to nonchoice riders. Neighborhood Transit would compete in the suburban market by offering benefits that match or exceed those of the private vehicle, including time savings, convenience, comfort, advanced technology, quality, access, and even a sense of community. Since Neighborhood Transit could be used for all trips, not just 20 to 25 percent that are work related, and assuming suburban travelers are sophisticated and rational and will pay a fair price for transportation that meets their needs and expectations, Neighborhood Transit should generate sufficient revenues to be self supporting. Preliminary estimates suggest that if Neighborhood Transit were used between 700 and 1,000 times per year, personal costs would range from $1,600 to $3,000 depending on the distance traveled. This represents a significant savings ($2,000 to $6,200) per year for each automobile. This is particularly important to a family that now must have more than one or two cars. With the NT, your teenagers or the second wage earner or even all wage earners could use the system for most of their normal

everyday trips. Imagine the cost savings if this NT could be incorporated as school busing. Your property taxes might even go down!

Research by O. J Smith at the Oak Ridge National Laboratory compared operating costs of fixed versus flexible route transit systems and found that it is possible to maintain the same area and frequency of service by using Neighborhood Transit and still reduce annual operating costs by nearly 50 percent over conventional fixed-route transit. Despite a slight increase in personnel needed to operate a computer based information system, savings are achieved by permitting the computer to select the most efficient route among origin and destination nodes rather than forcing a vehicle to follow a fixed path whether or not it is needed. The estimated costs on the Bergen County Community Commuter range from $1.50 to $3.00 per ride. The cost estimates were based on a detailed analysis of all equipment and operations costs. Assuming the purchase of all new equipment, average operating and maintenance costs and an operating profit, it is estimated that the system will only have to be subsidized during the months of start up.

**Conclusion**

Neighborhood Transit is a practical concept that has evolved over the last two decades of technological innovation. It offers commuters greater transportation choice in existing low-density, automobile-dominated suburbs. It also offers the opportunity to transport more people comfortably, thereby reducing impacts on street and highway networks, reducing parking requirements and decreasing air pollution and driving stress. Unlike regional transit, Neighborhood Transit is not dependent on development density and does not require urbanization or redevelopment; rather, its central organizing principle is travel time. As claims on Americans' time, money, and mobility grow more and more pressing, Neighborhood Transit will make more and more sense. The growing trend in home offices and electronic commuting combined with the Neighborhood Transit indicate a high potential for a new type of neighborhood and community which, if properly designed, can be interesting and exciting to live in, be economically responsible, cost efficient and technologically connected.